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## Morphological and nomenclatural notes on *Dianthus ciliatus* subspecies (Caryophyllaceae)

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### Abstract

A detailed morphometric analysis and scanning electron microscopy of seed coat structure of three currently recognised subspecies of the endemic amphi-Adriatic *Dianthus ciliatus* (Caryophyllaceae) was carried out for the first time. Petal limb shape and denticulation, the woody base of the plant, epicalyx scale's length and height of the epicalyx turned out to be the most informative characters in distinguishing the investigated populations of *D. ciliatus*. Based on significant differences in morphological characters, a new identification key is offered. The names *D. ciliatus*, *D. ciliatus* var. *cyomosus*, *D. dalmaticus*, *D. medunensis*, and *D. racemosus* are here lectotypified.

**Key words:** Amphi-Adriatic taxa, Apennine, Balkans, endemic taxa, typification

### Introduction

The genus *Dianthus* Linnaeus (1753: 409) is one of the largest genera of the family Caryophyllaceae Juss. with over 300 species native to Eurasia, Africa and America (Bittrich 1993, Mabberley 2008, Marhold 2011), many of them being endemic species in the Mediterranean area, south-western Asia, the Caucasus and the Irano-Turanian region (Bittrich 1993). In the flora of the Balkan Peninsula, about 170 species were recorded of which almost 100 are endemic (Radojević *et al.* 2010). They grow on various types of substrates, in open habitats such as rocky grasslands, steppes, sands, hilly and mountainous meadows, stony grounds, from lowland regions to mountain tops (Radojević *et al.* 2010). Within the genus *Dianthus* there are several morphologically and taxonomically well-defined groups. One of the most taxonomically challenging species complexes in the genus is known as *D. virgineus* Linnaeus (1753: 412) complex, which was typified by Domina *et al.* (2021a, 2021b). While *D. virgineus* s.str. applies to plants growing in peninsular Italy and France, in the Balkans *D. sylvestris* Wulfen in Jacquin (1787: 237) occurs (Gargano *et al.* 2023). Recently, the morphological differentiation of *D. sylvestris* on the Balkan Peninsula has been explored in detail (Terlević *et al.* 2022b), the morphological and genetic variation of *D. virgineus* in Central Italy (Franzoni *et al.* 2023a), as well as the cytosystematic variation of the whole *D. virgineus* complex (Terlević *et al.* 2022a; Franzoni *et al.* 2023b). *Dianthus ciliatus* Gussone (1825: 5) is an amphi-Adriatic species, morphologically close to the *D. virgineus* complex, that occurs in the Apennine and the Balkan Peninsulas (Tuttin & Walters 1964, Trinajstić 1979a, Greuter *et al.* 1984). Within this species, the following names have been validly published: *D. ciliatus* var. *cyomosus* Visiani (1852: 162), *D. ciliatus* var. *brocchianus* Visiani (1852: 162), *D. racemosus* Visiani (1829: 12), *D. dalmaticus* Čelakovský (1885: 189), and *D. medunensis* Beck & Szyszýowicz (1889: 66).

According to the first comprehensive checklist of the genus *Dianthus* (Fassou *et al.* 2022), *D. ciliatus* is treated as a species with three subspecies that are morphologically similar and geographically well defined in the Adriatic region. The autonymic subspecies *D. ciliatus* subsp. *ciliatus* is amphi-Adriatic and occurs in the northern and central Adriatic (Croatia, Italy), while *D. ciliatus* subsp. *dalmaticus* (Čelakovský) Hayek (1924: 246) is endemic to southern Adriatic (including southern part of Croatia, Bosnia and Herzegovina and Montenegro), and *D. ciliatus* subsp. *medunensis* (Beck & Szyszówicz) Trinajstić (1979: 8) is endemic to the southernmost part of the Dinaric region (Montenegro and Albania). Most of the authors who studied the flora of the Adriatic coast, did not distinguish subspecies within *D. ciliatus*, so that the actual distribution of these three subspecies and their range limits in the eastern Adriatic coast are not well known (Nikolić *et al.* 2015). Because of previously unclear morphological distinctions and due to the overlapping of morphological characters, it was not possible to define the subspecies unambiguously.

The aim of this contribution is to study the infraspecific variability of *Dianthus ciliatus* based on morphological characters and to review the taxonomy and nomenclature of the *D. ciliatus*, as well as to typify the names within this group. We also aimed to investigate by scanning electron microscopy (SEM) seed coat structure of the three currently recognized subspecies. By determining the morphological differences between these subspecies based on the examined morphological characters, a new identification key is created.

## Material and methods

Collections from the following herbaria and virtual herbaria APP, B, BEO, BEOU, BP, BR, E, G, HAL, HUJ, IB, K, L, LD, MW, NAP, P, PAD, PAL, PI, PR, PRC, TIR, W, WAG and WU were analysed and consulted in order to find the original materials of the names *Dianthus ciliatus*, *D. ciliatus* var. *cymosus*, *D. dalmaticus*, *D. medunensis* and *D. racemosus*. Herbarium acronyms are according to Thiers (2024). Field observations in the type localities were made during the period from 2018 to 2021 and herbarium specimens were collected for additional morphological comparison and correct identification of taxa (Fig. 1). Newly collected specimens are digitised and deposited in ZA and ZAGR collections according to Bogdanović *et al.* (2016) and Rešetnik *et al.* (2020). For nomenclatural issues the last ICN was followed (Turland *et al.* 2018, Turland 2019).

### Morphometrics

*Dianthus ciliatus* was studied in its whole distribution range. Field identification was based on morphological characters at the mature stage. Twenty-seven populations ( $n = 27$ ) were studied from the morphological point of view (Fig. 1, Appendix 1). For these populations character-states were measured for three individuals in each population.

Floral parts (Fig. 2) of one well-developed flower per plant were attached to transparent foil with adhesive tape, scanned on inverted Epson Expression 11000XL Pro A3 scanner and measured using the ImageJ program (Rueden *et al.* 2017).

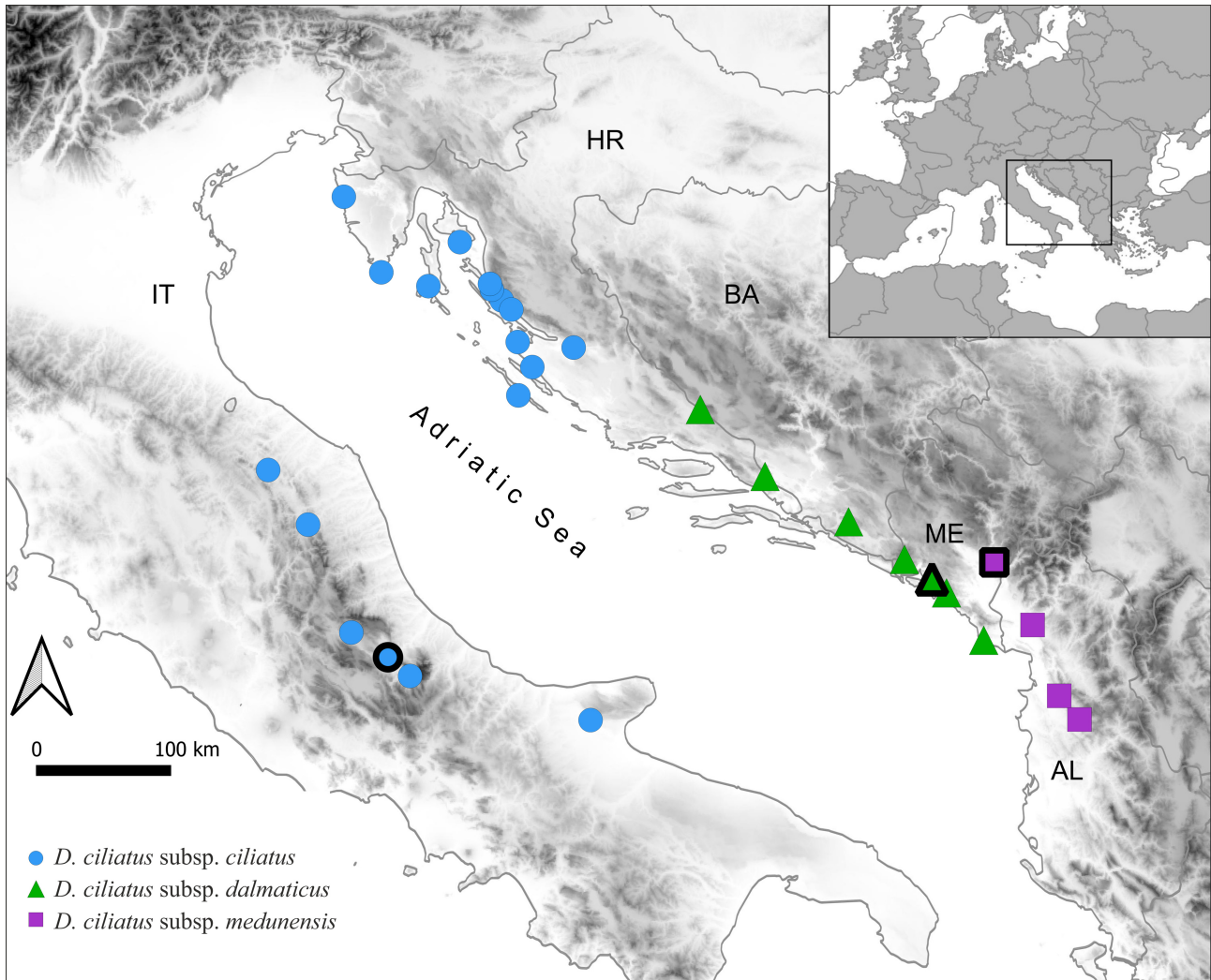
### Seed testa micromorphology

Seed testa micromorphology was studied on mature and dry seeds from herbarium specimens using SEM Zeiss EVO LS10. Five dried seeds per each subspecies were directly mounted onto aluminium stubs with double adhesive tape and coated with gold prior to observation according to the protocol reported by Stork *et al.* (1980), while terminology of the seed coat sculpturing follows Barthlott (1981) and Gontcharova *et al.* (2009).

### Data analysis

The morphological analyses were based on 84 individuals from 27 populations, including populations from the type localities whenever possible. Eighteen quantitative (Table 1, Fig. 3A) and four qualitative morphological characters (Fig. 3B) were examined for each individual.

Each of the four qualitative morphological characters had two possible states (Fig. 3B), and their total counts per subspecies were obtained to show differences of observed counts between subspecies. Quantitative morphological characters were examined using both univariate and multivariate methods. The Kruskal-Wallis test and Dunn's post hoc test with Bonferroni adjustment were performed on individual values for all quantitative morphological characters to evaluate statistically significant differences among subspecies (Table 1). To visualise the variability between subspecies, boxplots of quantitative morphological characters were generated from individual values (Fig. 3A).



**FIGURE 1.** Localities of sampled populations of taxa belonging to the endemic amphi-Adriatic *Dianthus ciliatus* used for morphometric analyses ( $n = 27$  populations). Type localities are indicated with thick black symbol outlines.

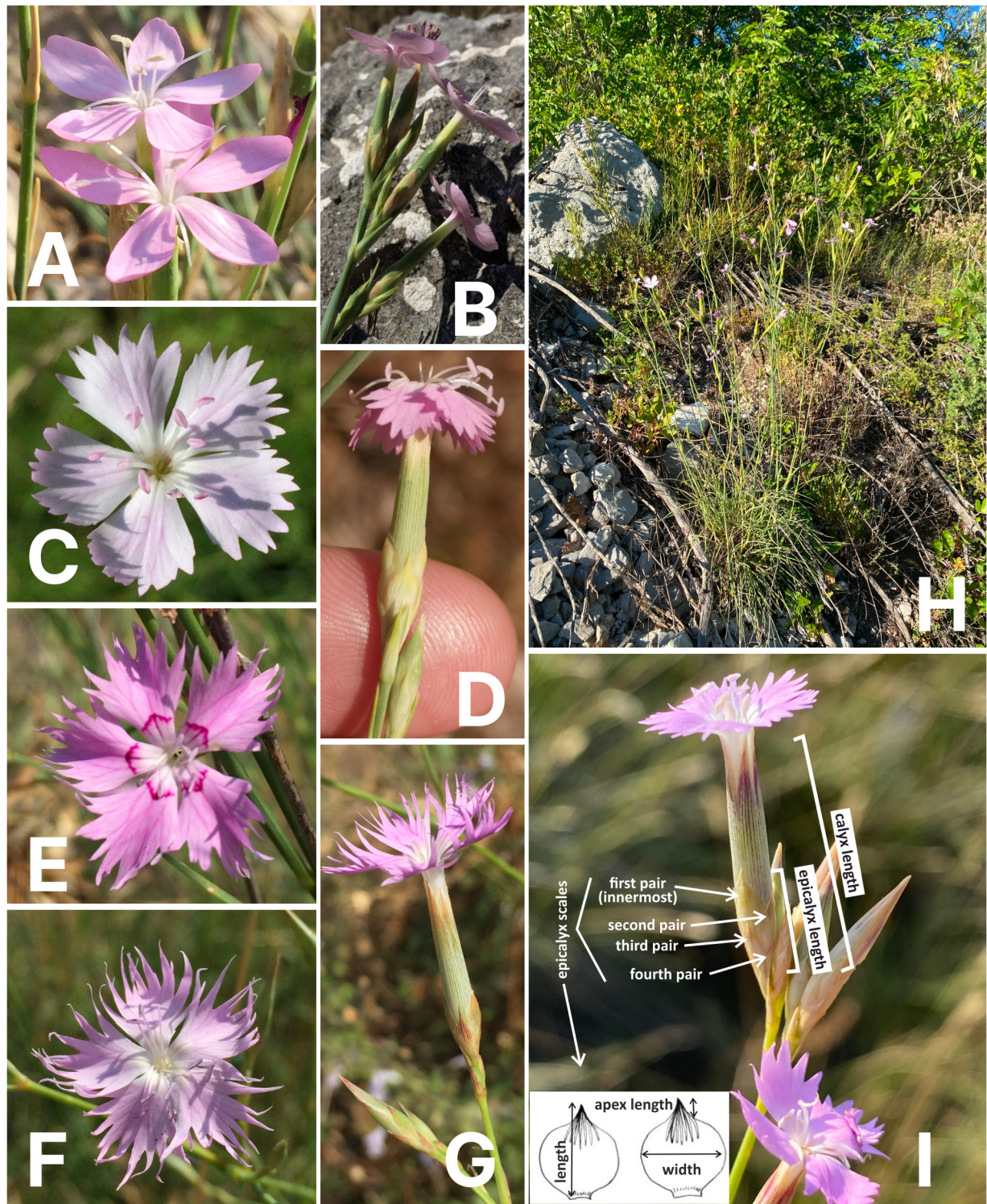
Before multivariate analyses, correlation among quantitative characters was tested using Spearman correlation coefficients ('corr.test' function of the 'psych' R package; Revelle, 2022). Correlation coefficients were based on the matrix including all the studied individuals to eliminate pairs of highly correlated characters that may distort downstream analyses. In the case of two highly correlated characters ( $r \geq |0.85|$ ), we decided to keep the character that displayed the higher statistical significance (smaller  $p$  value) among the subspecies according to the Kruskal-Wallis test. Principal component analysis (PCA) was performed based on measurements of individual plants, and based on the selected five quantitative morphological characters (Fig. 4), to display the morphological variability between subspecies of *Dianthus ciliatus*. PCA was carried out on the correlation matrix using the *base* R function 'prcomp'. All morphometric analyses were conducted in R v.4.1.0 (R Core Team, 2021).

## Results

### *Morphological variability*

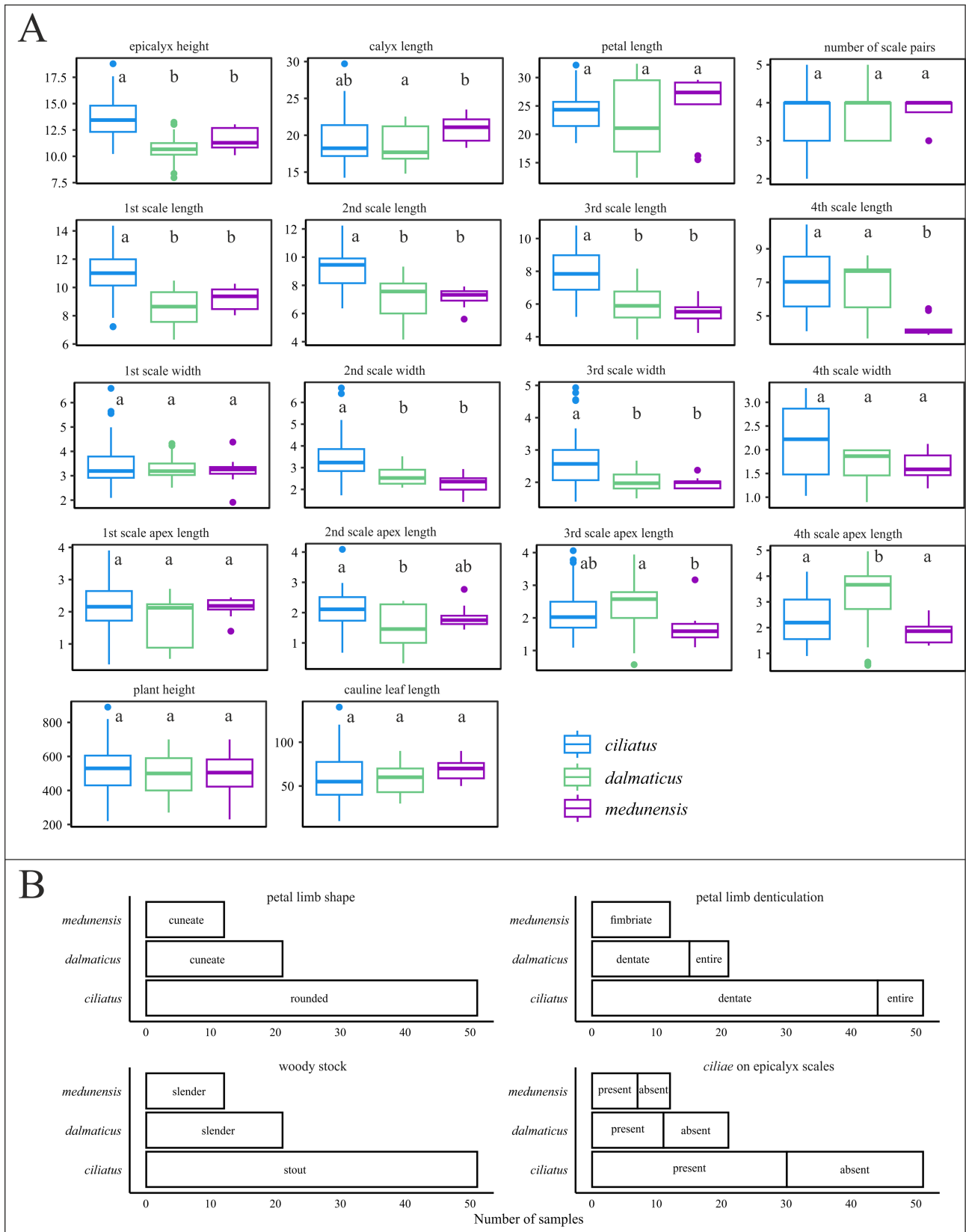
The range of values of quantitative morphological characters mostly overlapped between subspecies (Fig. 3A). However, according to Kruskal-Wallis test (Table 1), nine out of 18 investigated characters proved to significantly differ ( $p < 0.01$ ) between the three subspecies. Dunn's pairwise *post hoc* tests revealed that, for these nine characters, at least one pair of subspecies showed a significant difference. Epicalyx height and scale length of all measured scale pairs (four pairs) were the five most statistically significant characters (Table 1).





**FIGURE 2.** Morphological details of corolla and calyx in *Dianthus ciliatus* subsp. *ciliatus* (A, B), *D. ciliatus* subsp. *dalmaticus* (C, D), and *D. ciliatus* subsp. *medunensis* (E, F, G). Habitus of *D. ciliatus* from Popoli (*locus classicus*) in Abruzzo, Italy (H), and floral quantitative characters analysed (I). Photographs by S. Bogdanović.





**FIGURE 3. A.** Variation in quantitative characters, examined on 84 individuals of *Dianthus ciliatus*. Means not significantly different at  $p < 0.01$ , according to Dunn's post-hoc test, are indicated by the same letter. **B.** Barplots for the four qualitative characters examined on 84 *D. ciliatus* individuals, showing the number of individuals per character state and per subspecies.

**TABLE 1.** Eighteen quantitative morphological characters studied in *Dianthus ciliatus*. Significant differences ( $p < 0.01$ ) between *D. ciliatus* subspecies as revealed by Kruskal Wallis test are shown in bold.

	Kruskal Wallis rank sum statistic	<i>p</i> - value
Calyx length	6.24	0.044
Petal length	2.64	0.267
Epicalyx length	32.39	<b>&lt; 0.01</b>
First scale apex length	4.27	0.118
First scale length	31.70	<b>&lt; 0.01</b>
First scale width	0.07	0.964
Second scale apex length	10.29	<b>0.005</b>
Second scale length	34.31	<b>&lt; 0.01</b>
Second scale width	27.63	<b>&lt; 0.01</b>
Third scale apex length	8.87	0.011
Third scale length	32.76	<b>&lt; 0.01</b>
Third scale width	18.68	<b>&lt; 0.01</b>
Fourth scale apex length	12.46	<b>0.002</b>
Fourth scale length	21.25	<b>&lt; 0.01</b>
Fourth scale width	7.97	0.018
Number of epicalyx scale pairs	0.46	0.793
Plant height	0.94	0.624
Length of the cauline leaf from the second stem node	2.83	0.242

Analysis of qualitative morphological characters showed that populations referred to *Dianthus ciliatus* subsp. *ciliatus* include plants with stout woody stock and rounded and entire petal limbs, whereas those referred to *D. ciliatus* subsp. *dalmaticus* and *D. ciliatus* subsp. *medunensis* include plants with slender woody stock, cuneate petal limb shape, and dentate and fimbriate petal limbs respectively (Fig. 3B).

The PCA was performed on a selection of five quantitative characters (Fig. 4). The first principal component (PC1) explained 64.61% of total variation and the second principal component (PC2) explained 14.82%. Characters showing the highest correlation with the first axis (component scores ranging from 0.47 to 0.51) in the coefficient matrix were, listed in decreasing component score value, the first and second scale length and epicalyx height. A character that showed the highest correlation with the second axis (0.91) was the second scale apex length. When the individuals were considered in a bidimensional morphospace, the separation of *Dianthus ciliatus* subsp. *ciliatus* and *D. ciliatus* subsp. *dalmaticus* along PC1 and an overlap along PC2 were detected (Fig. 4). Indeed, *D. ciliatus* subsp. *ciliatus* is characterised by longer scales than those of *D. ciliatus* subsp. *dalmaticus*, whereas scale length values of *D. ciliatus* subsp. *medunensis* overlap with both subspecies.

### Seed testa micro-morphology (SEM)

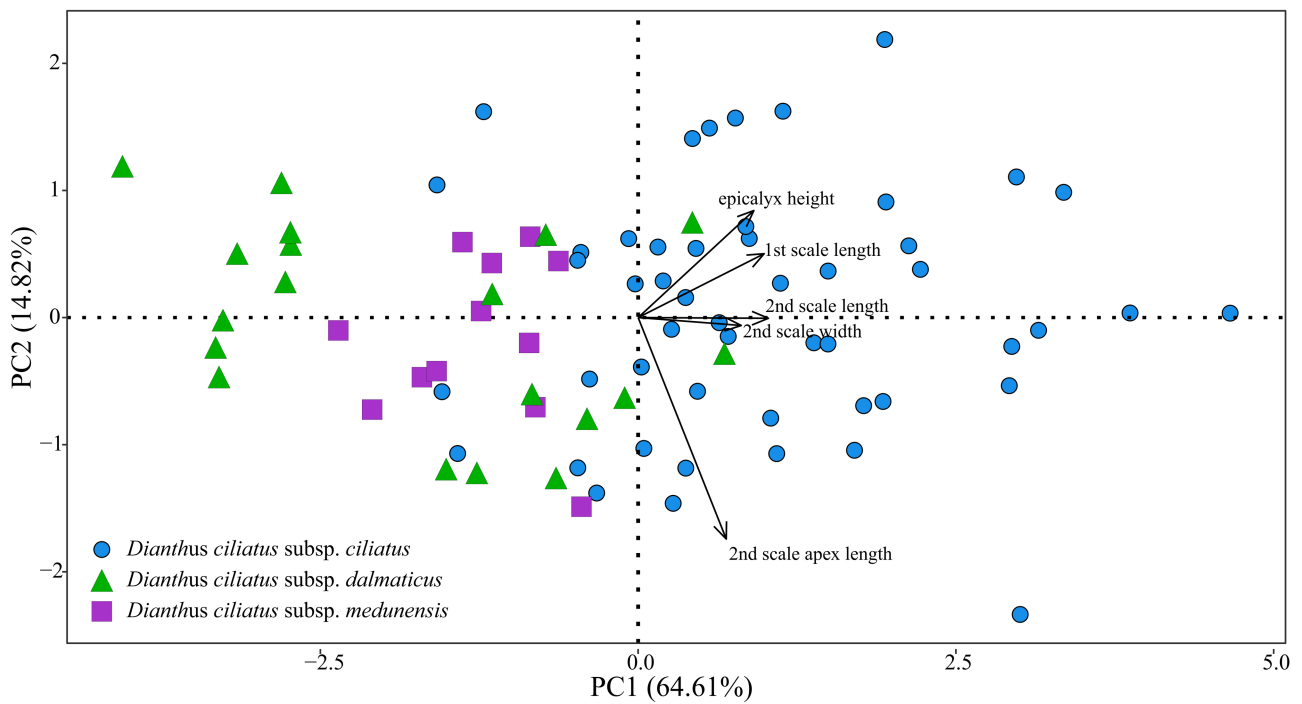
Seeds of *Dianthus ciliatus* subsp. *ciliatus* are elliptical, black, minutely granulate, and covered by irregularly elongated cells, undulate at the margins that have anticlinal walls with deep and wide grooves, irregularly tuberculate, with U-like undulations (Fig. 5A1–4). As concerns *D. ciliatus* subsp. *dalmaticus*, the seeds are elliptical, black, and covered with irregularly elongate cells, which are undulate at the margin, that have anticlinal walls with deep and narrow grooves, densely tuberculate, with U-like undulations (Fig. 5B1–4). Seeds of *D. ciliatus* subsp. *medunensis* are elliptical to suborbicular, black, densely granular, and covered by irregularly elongated cells, undulate at the margins, with deep and wide grooves, not tuberculate, with anticlinal walls having S- or U-like undulations (Fig. 5C1–4).

## Discussion

Three further taxonomic treatments have been proposed for taxa belonging to *Dianthus ciliatus*. The first one was proposed by Hayek (1924–1927) and then followed by Tutin & Walters (1964), who recognised two subspecies within *D. ciliatus*. The autonymic one, *D. ciliatus* subsp. *ciliatus*, from Italy and north-western Balkans, and *D. ciliatus* subsp. *dalmaticus* from south-western Balkans and western Albania. This taxonomic treatment is currently widely accepted and still in use (Greuter *et al.* 1984, POWO 2024). It is mainly based on very simple morphological distinctiveness between the two taxa: stock stout, stems little-branched (*D. ciliatus* subsp. *ciliatus*) vs. stock slender, stems much branched (*D. ciliatus* subsp. *dalmaticus*); cauline leaves usually 4–6 pairs, petals shallowly dentate or subentire (*D.*



*ciliatus* subsp. *ciliatus*) vs. cauline leaves usually 7–13 pairs, petals dentate (*D. ciliatus* subsp. *dalmaticus*). The second treatment was proposed by Trinajstić (1979a, 1979b), who recognised four taxa at subspecific level (*D. ciliatus* subsp. *ciliatus*, *D. ciliatus* subsp. *racemosus*, *D. ciliatus* subsp. *dalmaticus* and *D. ciliatus* subsp. *medunensis*). After a detailed inspection of the type specimens and based on our recent chorological (see Appendix 2) and morphological data, here we show that our results are in line with the more recent taxonomic treatment of *D. ciliatus* proposed by Marhold (2011) and Fassou *et al.* (2022), who recognize three subspecies. A new identification key is also provided for an easier identification of these subspecies.



**FIGURE 4.** Principal component analysis (PCA) based on five quantitative characters examined on 84 individuals of *Dianthus ciliatus*, represented by the first two principal components; taxonomic identification at the intraspecific level, based on regional keys and floras, is projected using differently coloured symbols.

Characters of epicalyx scale's pairs and height of the epicalyx itself turned out to be the most informative in distinguishing the investigated populations of *Dianthus ciliatus*. None of these morphological characters have been used so far in identification keys or in local floras. Therefore, the obtained data are important in the taxonomy of the group.

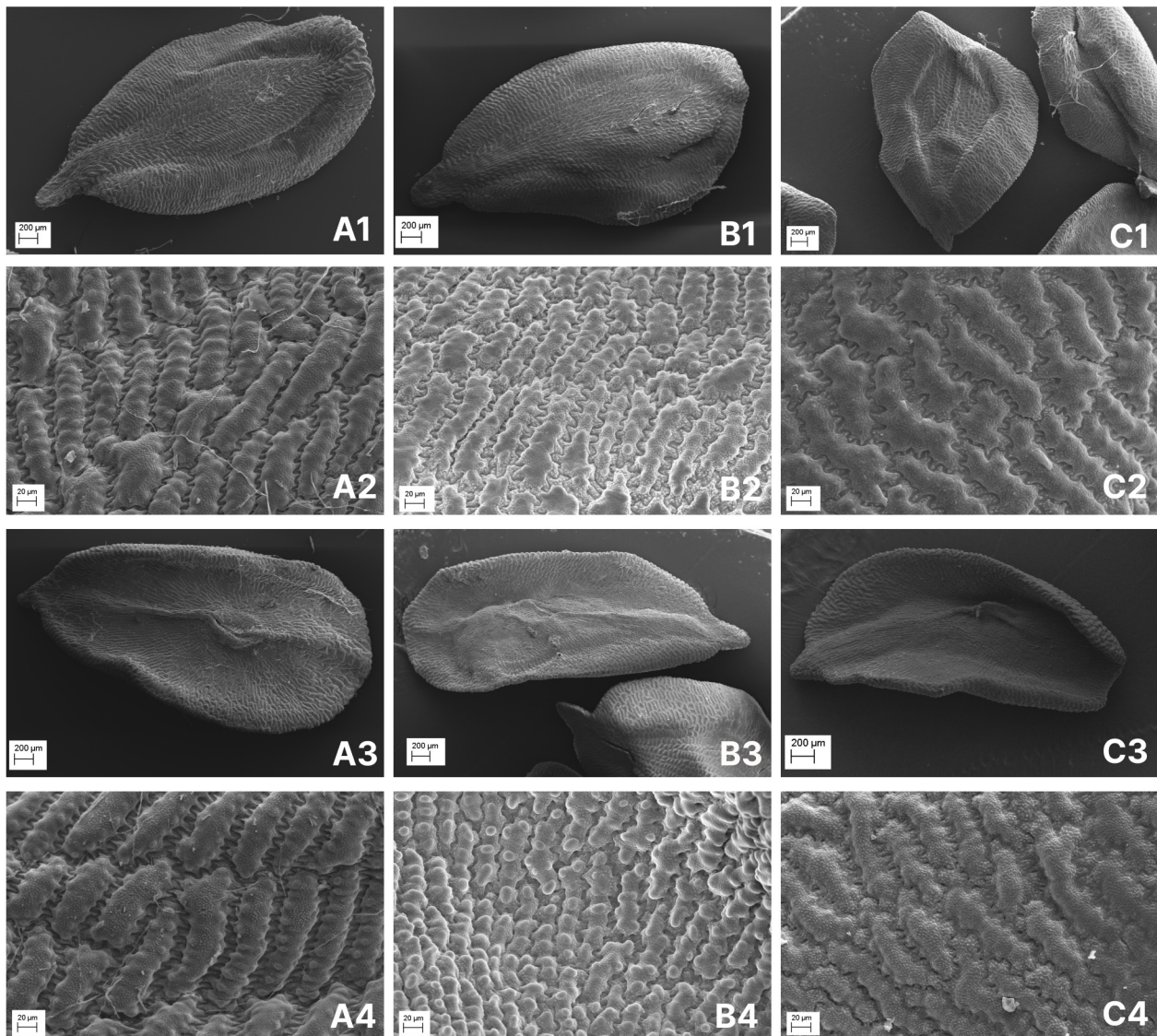
Qualitative characters such as the petal limb shape and denticulation, and the woody base of the plant were used in previous identification keys (Hayek 1924, Tutin 1964, Trinajstić 1979a, Tutin & Walters 1993). Our study showed that these characters can be used to distinguish subspecies, while other characters such as the number of pairs of epicalyx scales (which varies from 3–5) and the presence of short ciliate hairs (*ciliae*) on scale margin (glabrous to ciliated) are not useful. Characters such as slender woody stock and the cuneate petal limb are characteristic for *Dianthus ciliatus* subsp. *dalmaticus* and *D. ciliatus* subsp. *medunensis*, whereas the autonymic subspecies is marked by a stout woody stock and a rounded petal limb. In addition, petal limb denticulation, mentioned by previous authors (Hayek 1924, Trinajstić 1979a, Tutin 1964, Tutin & Walters 1993) is also informative. Thus, the petal limb is in most cases entire in *D. ciliatus* subsp. *ciliatus*, exclusively fimbriate in *D. ciliatus* subsp. *medunensis*, and denticulate in *D. ciliatus* subsp. *dalmaticus* (Fig. 3B).

This research showed that *Dianthus ciliatus* subsp. *dalmaticus* and *D. ciliatus* subsp. *medunensis* are morphologically very close, except for the difference in petal limb denticulation. Due to such similarities, some authors (Hayek 1924, Greuter *et al.* 1984, Tutin & Walters 1993) considered *D. ciliatus* subsp. *medunensis* as a heterotypic synonym of *D. ciliatus* subsp. *dalmaticus*. Beck & Szyszylowicz (1888) already mentioned and described *D. medunensis* for the area of Montenegro, which would differ from *D. ciliatus* subsp. *dalmaticus* mainly by the petal limbs incised into more or less filamentous spiracles. Later, Trinajstić (1979a) treated it as a separate subspecies, and Hayek (1924) even as a variety of *D. ciliatus* subsp. *dalmaticus* var. *medunensis* (Beck & Szyszylowicz) Hayek (1927: 246). A similar geographical pattern with two groups of populations morphologically splitting in the central Adriatic region was observed in the

amphi-Adriatic *Genista sericea* (see Conti *et al.* 2014). The differentiation into two groups along the Dinaric region was also documented in thermophilic species *Viola suaveis* (see Mered'a *et al.* 2011) and in *D. sylvestris* (Terlević *et al.* 2022b).

Generally, the seeds of *Dianthus* species are black, flat, peltate, cuspidate at apex, with elongated cells on coat surface that are undulate at the margins, and more or less minutely papillose (Yildiz 2002, Vural 2008, Yıldiz & Güzel 2008, İlçim *et al.* 2013, Hamzaoğlu *et al.* 2015a, 2015b, Hamzaoğlu & Koç 2015, Brullo *et al.* 2015, Deniz *et al.* 2016). The seeds of *Dianthus ciliatus* are in accordance to previous description. Based on SEM, the seed coat surface among three subspecies of *D. ciliatus* have micromorphological differences that are detected in incisions of anticlinal walls, tuberculation and undulations (Fig. 5).

A new identification key for subspecies of *Dianthus ciliatus* is provided, which includes newly observed significant quantitative characteristics related to the epicalyx.



**FIGURE 5.** Scanning electron micrographs of the seed coat of *Dianthus ciliatus* subsp. *ciliatus* (A1–4), *Dianthus ciliatus* subsp. *dalmaticus* (B1–4), and *D. ciliatus* subsp. *medunensis* (C1–4). 1. Seed (dorsal face,  $\times 25$ ). 2. Seed coat (central part of dorsal face,  $\times 300$ ). 3. Seed (ventral face,  $\times 25$ ). 4. Seed coat (central part of ventral face,  $\times 300$ ).



## Typification of the names

The following names are here lectotypified according to the ICN Chapter II, Section 2, Art. 10 (Turland *et al.* 2018).

### 1. *Dianthus ciliatus* Gussone (1825: 5)

**Lectotype** (designated here):—ITALY. Popoli-Aquila-Roca Casale, 1824, *Gussone s.n.* (NAP-Gussone Generale!, Fig. 6).

= *Dianthus racemosus* Visiani (1829: 12) ≡ *Dianthus ciliatus* subsp. *racemosus* (Visiani 1829:12) Hayek (1924: 246) ≡ *Dianthus ciliatus* var. *racemosus* (Visiani 1829:12) Visiani (1852: 162).

**Lectotype** (designated here):—CROATIA. Dalmatia. Sib.co [Sibenico] in colle S. Giorgio, s.d., *Visiani s.n.* (PAD-HD05069!, right specimen).



**FIGURE 6.** Lectotype of the name *Dianthus ciliatus* (NAP-Gussone Generale!).

**Notes:**—In 1825 Gussone published the name *Dianthus ciliatus* in Index Seminum Horto Regio in Boccadifalco, with the following short description: “*D. Hornemanni* Dc. *affinis; sed distinguitur petalis nunquam incise, foliis enerviis. In Aprutio*”. Subsequently, Gussone (1826) provided a very detailed description (Gussone 1826: 168) and iconography of *D. ciliatus* (Gussone 1826: tab. 33). In addition, he provided more precise information on type of habitat and localities

where *D. ciliatus* was found: “*In collibus aridissimis calcareis, et ad radices montium Aprutii meridiem spectantibus; Rajano, Sulmona, al Morrone da Popoli a Pacentro*”. Examining herbarium materials in Gussone’s collection in NAP we were able to trace two herbarium sheets collected in 1824 from Popoli-Aquila and Morrone-Rocacasale in Abruzzo, that are part of the original material. We chose the specimen from NAP-Gussone Generale as a lectotype of the name *D. ciliatus* (Fig. 6).

**Habitat and phenology:**—In Italy, this species (Fig. 2A, H) grows on dry rocky places, calcareous rocky grasslands within the sub-Mediterranean zone, while in Croatia within the eu-Mediterranean zone on the same habitats and also on littoral rocky places, inland cliffs and along the roads. The flowering period of this species is from late May to late July and fructifying period is in summer from late June to late July.

**General distribution:**—Italy and Croatia (Fig. 1). Typical *Dianthus ciliatus* occurs in central Apennine Peninsula in following regions: Abruzzo, Marche, Molise, Toscana and Puglia, and along the northern part of the eastern Adriatic coast in the following Croatian regions: Istria, Kvarner, northern and central Dalmatia.

**Other original material examined:**—ITALY. Morrone sopra Roca Casale, 9 August 1824, Gussone s.n. (NAP-Gussone Generale!).

## 2. *Dianthus ciliatus* Gussone var. *cymosus* Visiani (1852: 162)

**Lectotype** (designated here):—MONTENEGRO. In apricis circa Ragusa et Cattaro, s.d., Visiani s.n. (PAD-HD05071!).

**Note:**—The illustration that Visiani gave in his Flora Dalmatica (1847: Tab. XXV, fig. 1b), named *Dianthus racemosus*, belongs to this variety. *Dianthus ciliatus* Guss. var. *cymosus* Visiani (1852: 162) was described from Ragusa and Cattaro “*In apris circa Ragusa et Cattaro*”, whose herbarium specimens we were able to trace in PAD herbarium and here we select the specimen PAD-HD05071! as lectotype. This name has to be linked to *D. ciliatus* subsp. *dalmaticus* because the illustration given by Visiani (1847: Tab. XXV, fig. 1b) and diagnosis in the protologue “*floribus longe pedunculatis subsolitariis, pedunculis cymosis paniculatisve, petalorum lamina obovate*” correspond to lately described *D. dalmaticus* by Čelakovský (1885: 189) who also cited this Visiani’s name as a synonym in the protologue.

The name *Dianthus ciliatus* var. *cymosus* is validly published and today is treated as a synonym of *D. ciliatus* subsp. *dalmaticus*.

**Other original material examined:**—MONTENEGRO. Cattaro, Ragusa, s.d., Visiani s.n. (isolectotypes: PAD-HD05072!, PAD-HD05073!).

## 3. *Dianthus ciliatus* subsp. *dalmaticus* Čelakovský (1885: 189) Hayek (1924: 246) ≡ *Dianthus dalmaticus* Čelakovský (1885: 189)

**Lectotype** (designated here):—MONTENEGRO. Flora von Dalmatien. In apricis saxois prope Cattaro, July 1877, Studniczka s.n. (PR 836441!, Fig. 7)

= *Dianthus ciliatus* Gussone (1825: 5) var. *cymosus* Visiani (1852: 162).

**Lectotype** (designated here):—MONTENEGRO. In apricis circa Ragusa et Cattaro, s.d., Visiani s.n. (PAD-HD05071!).

**Notes:**—In 1885 Čelakovský described this species based on herbarium specimens collected in 1877 by K. Studniczka in Kotor (Cattaro) from Montenegro (Čelakovský 1885). Three relevant herbarium sheets were found at PR that are in relation to the name *Dianthus dalmaticus*. There is no Čelakovský’s identification in the specimens, but only the annotation “*non est*” crossed out the name *Dianthus ciliatus* Guss. β *cymosus* on the sheet PR 836441. This note is in Čelakovský’s handwriting and it is evident that he saw this specimen and cited it in the protologue, so we chose the specimen PR 836441 as lectotype for the name *D. dalmaticus* (Fig. 7). The second specimen (PR 86229) is a duplicate and here considered as isolectotype, which was however incorporated in PR much later, in the last third of the 20<sup>th</sup> century (Otakar Šída, pers. comm.). The third specimen (PR 836442) could have a relation to the specimen or name mentioned by Čelakovský in the protologue, since Čelakovský nearly surely studied this specimen from Ragusa (Dubrovnik in Croatia) as well.

**Habitat and phenology:**—*Dianthus ciliatus* subsp. *dalmaticus* (Fig. 2C, D) occurs in the eu-Mediterranean and sub-Mediterranean zone of the eastern Adriatic coast and inland, occupying colder habitats, on screes, walls, rocky places, along roads, in fissures of rocky places and on deciduous forest margins. The flowering period is from mid-July to mid-August, fruiting in late August to September.

**General distribution:**—Croatia, Montenegro, Bosnia and Herzegovina (Fig. 1).

**Other original material examined:**—MONTENEGRO. Flora von Dalmatien. In apricis saxosis prope Cattaro, July 1877, Studniczka s.n. (isolectotypes: PR 86229!, K 000725360!, BEOU!; BP HNHM-TRA 00183940!).







**4. *Dianthus ciliatus* subsp. *medunensis*** (Beck & Szyszylowicz 1888: 66) Trinajstić (1979b: 8)

≡ *Dianthus medunensis* Beck & Szyszylowicz (1888: 66) ≡ *Dianthus ciliatus* subsp. *dalmaticus* var. *medunensis* (Beck & Szyszylowicz 1888: 66) Hayek (1924: 246).

**Lectotype** (designated here):—MONTENEGRO. Medun, July 1886, *Szyszylowicz s.n.* (PRC 455887!, Fig. 8).

—*Dianthus ciliatus* subsp. *medunensis* (Beck & Szyszylowicz 1888: 66) Trinajstić (1979a: 751), *nom. inval.* (Art. 6, 29–31, 31–45 of ICN).



**FIGURE 8.** Lectotype of the name *Dianthus medunensis* (PRC455887!).

**Notes:**—*Dianthus medunensis* was described by Beck and Szyszylowicz (1888) and illustrated in Beck & Szyszylowicz (1888: table 3, fig. a, b, c) from Medun in Montenegro. Subsequently, Szyszylowicz (1889: 118) republished again the same description in a separate paper. We were able to find original material in PRC herbarium that without any doubt belongs to Szyszylowicz's original collection (PRC 455887!), and here we choose this specimen as lectotype (Fig. 8).

**Ecology and phenology:**—*Dianthus ciliatus* subsp. *medunensis* (Fig. 2E, F, G) grows within sub-Mediterranean zone on calcareous rocky places, rocky grasslands, vertical inland cliffs, along roads and deciduous forest margins, where the specimens are rare in the field. It flowers from the end of June to the end of July, and fruits in August to September.

**General distribution:**—Albania and Montenegro (Fig. 1). It occurs in the central part of Montenegro and central and north-western part of Albania.

**5. *Dianthus racemosus*** Visiani (1829: 12)

**Lectotype** (designated here):—CROATIA. Dalmatia. *Sib.co [Sibenico] in colle S. Giorgio, Visiani s.n., s.d.* (PAD-HD05069!, right specimen).

**Notes:**—*Dianthus racemosus* was described by Visiani (1829), who cited a specimen from Šibenik in Dalmatia: “*Sib.co [Sibenico] in colle S. Giorgio*”. The protologue includes a morphological description and the indication of the geographical area in which the species occurs: “*In agri Sibenicensis collibus humilioribus asperis alle Torette, S. Giorgio et Jaderae*”. In PAD herbarium we found a Visiani specimen (PAD-HD05069!) that certainly is original material, and here we select the right individual as lectotype. A confusion with the name *D. racemosus* happened when Visiani provided an illustration of two plants of *D. racemosus* in the second volume of his *Flora Dalmatica* (1847: fig. 1a and fig. 1b on table 35). In fact, the plants shown on his table 35 clearly belong to two different taxa. Twenty-three years later, Visiani in the third volume of his *Flora Dalmatica* (1852: 162) made a new combination: “*Dianthus ciliatus* var. *racemosus*”. This name is superfluous because Visiani cited *D. ciliatus* b. *litoralis* as a synonym, referring to Reichenbachs’ *Icones Florae Germanicae et Helveticae* 6 (Reichenbach 1844: 47, pl. 226, fig. 5047).

The name *Dianthus racemosus* is validly published and today is accepted and treated as a synonym of *D. ciliatus* subsp. *ciliatus*.

**Other original material examined:**—CROATIA. In coll. Dalm. *Visiani s.n., s.d.* (HAL-11254!).

**Identification key for the subspecies of *Dianthus ciliatus* s.l.**

1. Woody stock short, stout; stems slightly divaricated; basal leaves numerous in rosette, cauline leaves usually 4–6 pairs; petals entire to subentire, rarely subdentate; petal limb rounded; epicalyx (10.2–)12.3–14.8(–18.8) mm long; first scale (7.2–)10.1–12(–14.4) mm long, second scale (6.4–)8.2–9.9(–12.2) × (1.7–)2.8–3.9(–6.7) mm, third scale (5.2–)6.9–9.0(–10.8) × (1.4–)2.1–3.0(–4.9) mm.....subsp. *ciliatus*
- Woody stock long, slender; stems very divaricated; basal leaves not present, cauline leaves usually 7–13 pairs; petals dentate to fimbriate; petal limb cuneate; epicalyx (8.0–)10.1–12.7(–13.2) mm long; first scale (6.3–)7.6–9.9(–10.5) mm long, second scale (4.2–)6.0–8.1(–9.3) × (1.4–)2.0–2.9(–3.5) mm, third scale (3.8–)5.1–6.8(–8.2) × (1.5–)1.8–2.2(–2.7) mm .....2
2. Petal limb pale pink, rarely white, dentate, rarely entire; fourth scale (3.7–)5.5–7.8(–8.6) mm long, with apex (0.5–)2.7–4.0(–5.0) mm long.....subsp. *dalmaticus*
- Petal limb pinkish-red, dentate-fimbriate; fourth scale (3.9–)4.0–4.2(–5.4) mm long, with apex (1.3–)1.4–2.0(–2.7) mm long.....subsp. *medunensis*

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**APPENDIX 1.** Studied populations of *Dianthus ciliatus* (27). Herbarium acronyms are according to Thiers (2024).

ID pop	Name	Country	Locality	Long. (N)	Lat. (E)	Altitude (m)	Voucher ID	Collector(s)	Collection date
D31	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Ribarica	44.555392	15.03378	2	ZA 47431	I. Rešetnik <i>et al.</i>	15 June 2018
D35	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Obrovac	44.20166	15.67819	46	ZA 47435	I. Rešetnik <i>et al.</i>	16 June 2018
D72	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Krk	44.96677	14.67183	20	ZA 48602	S. Bogdanović, I. Ljubičić	6 September 2018
D73	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Dugi otok	43.90588	15.13167	175	ZA 48603	S. Bogdanović, I. Ljubičić	7 September 2018
D74	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Zadar	44.09049	15.27934	62	ZA 48604	S. Bogdanović, I. Ljubičić	7 September 2018
D75	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Rt Kamenjak	44.79324	13.912	10	ZA 48605	S. Bogdanović	22 September 2018
D98	<i>D. ciliatus</i> subsp. <i>medunensis</i>	Montenegro	Medun	42.46926	19.36156	472	ZA 48615, ZAGR 62692	S. Bogdanović, I. Ljubičić	15 July 2018
D100	<i>D. ciliatus</i> subsp. <i>dalmaticus</i>	Montenegro	Ulcinj	41.95453	19.1859	279	ZA 48617	S. Bogdanović, I. Ljubičić	15 July 2018
D101	<i>D. ciliatus</i> subsp. <i>dalmaticus</i>	Montenegro	Budva	42.30353	18.89902	808	ZA 48618	S. Bogdanović, I. Ljubičić	16 July 2018
D104	<i>D. ciliatus</i> subsp. <i>dalmaticus</i>	Montenegro	Kotor	42.40872	18.78053	634	ZA 48621	S. Bogdanović, I. Ljubičić	16 July 2018
D105	<i>D. ciliatus</i> subsp. <i>dalmaticus</i>	Montenegro	Mt Orjen	42.56142	18.55139	1689	ZA 48622	S. Bogdanović, I. Ljubičić	17 July 2018
D159	<i>D. ciliatus</i> subsp. <i>dalmaticus</i>	Bosnia and Herzegovina	Trebišnjica river	42.85681	18.07862	310	ZA 54965	S. Bogdanović <i>et al.</i>	29 June 2019
D167	<i>D. ciliatus</i> subsp. <i>dalmaticus</i>	Croatia	Vrgorac	43.22	17.35361	385	ZA 54973	M. Vukojević	12 September 2019
D189	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Antenal	45.31639	13.59028	13	ZA 56818	A. Terlević	19 July 2020
D190	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Osorščica	44.68235	14.35009	259	ZA 56819	M. Doboš, S. Bogdanović	20 July 2020
D191	<i>D. ciliatus</i> subsp. <i>dalmaticus</i>	Croatia	Kamešnica	43.71254	16.81212	876	ZA 56820	S. Bogdanović	22 July 2020
D194	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Starigrad	44.54796	15.04659	18	ZA 56823	M. Doboš, S. Bogdanović	20 July 2020
C2	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Croatia	Sabunike	44.266528	15.1583	5	ZAGR 58750	S. Bogdanović	26 July 2020.
D200	<i>D. ciliatus</i> subsp. <i>medunensis</i>	Albania	Dajti Mt	41.33946	19.95709	970	ZA 56849, ZAGR 62688	D. Shuka	21 August 2020
D202	<i>D. ciliatus</i> subsp. <i>medunensis</i>	Albania	Kruja Mt	41.51661	19.80233	1100	ZA 57634, ZAGR 62689	D. Shuka	19 September 2020
D203	<i>D. ciliatus</i> subsp. <i>medunensis</i>	Albania	Vau i Dejes	42.01618	19.64073	100	ZA 57635, ZAGR 62690	D. Shuka, L. Shuka	20 September 2020
D209	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Italy	Sant Abbondio	43.49049	12.77549	496	ZA 62645	I. Rešetnik <i>et al.</i>	29 June 2021

...continued on the next page

**APPENDIX 1.** (Continued)

ID pop	Name	Country	Locality	Long. (N)	Lat. (E)	Altitude (m)	Voucher ID	Collector(s)	Collection date
D210	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Italy	Sfercia	43.11047	13.12434	368	ZA 62646	I. Rešetnik <i>et al.</i>	29 June 2021
D215	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Italy	Aquila	42.36692	13.47975	724	ZA 62649, ZAGR 62677	I. Rešetnik <i>et al.</i>	29 June 2021
D217	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Italy	Popoli	42.18745	13.80129	556	ZA 62650, ZAGR 62678	I. Rešetnik <i>et al.</i>	30 June 2021
D218	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Italy	Pacentro	42.05255	13.99351	694	ZA 62651, ZAGR 62679	I. Rešetnik <i>et al.</i>	30 June 2021
D229	<i>D. ciliatus</i> subsp. <i>ciliatus</i>	Italy	Rignano Garganico	41.67642	15.59336	506	ZA 62654	I. Rešetnik <i>et al.</i>	4 July 2021

**APPENDIX 2.** Additional examined specimens of *Dianthus ciliatus* from different herbaria.

***Dianthus ciliatus* subsp. *ciliatus*:—CROATIA.** Istria: Aufgelassener Steinbruch an Mirna-Mündung bei Antenal, 28 September 2018, *S. Lefnaer s.n.* (WU 0104761!); Istrien, Pola: Felsen bei Veruda, 26 October 1889, *K. Untchj s.n.* (P 05082525!); Pola, July 1882, *Starlmann s.n.* (IB 5259!); Istrien, Ostküste bei Tunarica (Labin), July 1997, *G. Gärtner s.n.* (IB 5880!); In collibus ad marem spectantibus prope oppidum Pola Istriae, July 1826, *J. Freyn s.n.* (IB 5258!); In collibus ad marem spectantibus prope oppid. Pola Istriae, July 1876, *J. Freyn s.n.* (BP HNHM-TRA 00183933!); Istrien, Macchien bei Pola, 26 July 1876, *J. Freyn s.n.* (BP HNHM-TRA 00183952!); Flora Illirico-Littoralis, in rupibus ad mare non procual ab oppido Pola, Istria, s.d., *M. Tommasini 5118* (IB 5805!); Flora Insel Unie, Stiene, 5 September 1891, *A. Haraëić s.n.* (BP HNHM-TRA 00183950!); Insel Arbe, Felsenheide bei der Pta. Ferzanjo, ca 10 m, 3 August 1912, *F. Morton 629* (WU 0105420!; WU 0105421!; WU 0105422!); Dalmatia: Dizmon pr. Clissa, in collib. aridis, July 1870, *Th. Pichler 222* (BEOU!; WU 105431!); Dalmatia. Gebirgspflanze, Auf dem Berge Svilaja unweit Spalato, August, *F. Petter 137* (WU 105452!; BP HNHM-TRA 00183969!; BP HNHM-TRA 00183970!; P 04921215!); e Dalmat., s.d., *R. de Visiani s.n.* (BEOU!); Istria. In saxosis apricis prope Polam, s.d., *Neugebauer s.n.* (BEOU!; L 1702789!; MW 0774052!; BP HNHM-TRA 00183946!; BP HNHM-TRA 00183947!); in rupestribus graminosis ad pagum Besca nuova, solo. calc., 24 July 1876, *V. de Borbás s.n.* (BEOU!); Insula Veglia, in rupestribus herbis ad Besca nuova, July 1876, *V. de Borbás s.n.* (BP HNHM-TRA 00183973!); Istria, Pola: Canale di Veruda, 14 September 1881, *P. Sintenisi s.n.* (B 10 1024833!); ... [illeg.] bei Pola, *M. Tommasini s.n.* (B 10 0749332!); vallis fluvii Zrmanja, pars inferior: in prato humido apud viam ad vicum parvum Berberi, 14 m s. l. m., 6 October 2006, *P. Koivka s.n.* (B 10 0418133!); In scopulis marinis insularum Istriae australis, s.d., *M. Tommasini s.n.* (B 10 1040383!); Flora von Istrien, Felsen bei Veruda, Pola, 28 July 1883, *K. Untchj s.n.* (B 10 1040381!); Insel Cherso, 9 July 1930, *F. Morton 585* (B 10 0082863!); Starigrad, locis graminosis ad deversorium Alan ad marginem merid. oppiduli Starigrad, alt. 5 m s.m., 5 September 1979, *F. Èrnoch 35474* (B 10 1040385!; B 10 1040386!); Dalmatien, s.d., *F. Petter s.n.* (B 10 0749375!); Istrien. Klippen bei Pola, 26 July 1876, *J. Freyn s.n.* (L 1702788!); Lesina, Dalmatia, s.d., *M. Botteri s.n.* (E 01053165!); In calcareis Dalmatia juncta Zara, 29 September 1854, *J. Ball s.n.* (E 01053166!); In saxosi Dalmatiae, Unio itineraria 1829, s.coll., s.n. (E 01053167!); Pula, Verudela, Verudica Cape, west of Havajka beach, littoral rocky coast, 9 m alt., 17 May 2018, *Bogdanović & Ljubičić s.n.* (ZA 46414!); Vir island, Rastovac, NW of Lozice village, along the road, above the rocky coast, 7 m alt., 31 May 2018, *Ljubičić s.n.* (ZA 46608!); Senj, Trbušnjak, Zidine, vertical rocks along the road, 51 m alt., 14 June 2018, *Rešetnik, Bogdanović & Ljubičić s.n.* (ZA 47426!); Ribarica, Uvala Drvarica, littoral rocky coast, 2 m alt., 15 June 2018, *Rešetnik, Bogdanović & Ljubičić s.n.* (ZA 47431!); Vransko jezero, E side, maquis and garrigue near macadam, 4 m alt., 18 June 2018, *Rešetnik, Bogdanović & Ljubičić s.n.* (ZA 47454!); Island of Krk, Stara Baška, Orlovica, rocky grassland above the sea, 20 m alt., 6 September 2018, *Bogdanović & Ljubičić s.n.* (ZA 48602!); Dugi otok, PP Telašćica, Grpašæak, edges of cliffs, 175 m alt., 7 September 2018, *Bogdanović & Ljubičić s.n.* (ZA 48603!); Rt Kamenjak, S of Premantura, Polje, rocky grassland, along the sea coast, 10 m alt., 22 September 2018, *Bogdanović s.n.* (ZA 48605!); Istria, Antenal, Novigrad, rocks along the road, 13 m alt., 19 July 2020, *Terlević s.n.* (ZA 56818!); Lošinj, Osorëica, vertical carbonate cliffs, SW, 259 m alt., 20 July 2020, *Bogdanović & Doboš s.n.* (ZA 56819!); Istria, Koromaëno, rocks on the sea coast, 7 m alt., 8 August 2021, *Terlević s.n.* (ZA 62643!); Unešić, at the train station, dry rocky grassland, 355 m alt., 24 July 2021, *Bogdanović & Milović s.n.* (ZA 62661!); Klis, Klis-Grlo, dry rocky grassland, 368 m alt., 10 August 2021, *Bogdanović s.n.* (ZA 62665!); National Park Krka, Roški slap, rocks and rocky grassland along the road, 88 m alt., 25 July 2021, *Bogdanović s.n.* (ZA 62667!); Island Tijat, islet Kamenica, dry rocky halophilous grassland, 1 m alt., 23 August 2021, *Bogdanović s.n.* (ZA 62669!); National Park Kornati, Mala Panitula, rocky halophilous grassland, 2 m alt., 23 August 2021, *Bogdanović s.n.* (ZA 62670!); Istria, Rovinj, Škaraba beach, grassland along the sea, 2 m alt., 21 August 2021, *Dobrović s.n.* (ZAGR 62526!); In lapidosis ad portum Obbrevazzo Dalmatiae, 9 September 1910, *Kümmerle s.n.* (BP HNHM-TRA 00183938!). **ITALY.** Pendi è rupi calcaree: Poggio Valle, 900-1200 m, August 1944, *G. Zodda s.n.* (HUJ 133521!); Abruzzo, Gruppo del Gran Sasso tra Calascio e Ofena (AQ), pendii rupestri, 800 m circa, 23 July 1999, *F. Conti, D. Lakušić & Ph. Küpfer s.n.* (APP 1097, BEOU 55037!); San Demetrio, ad merid. urbis Aquila, in dumetis ad laculum “di Sinezza”, 14 July 1882, *E. Levier s.n.* (BEOU!; L 1702790!); Picenum, Ascoli Piceno, frequens in apricis saxosis collium prope urbem, alt. 100 m., solo calcareo, July 1911, *L. Vaccari s.n.* (WU 0105419!; MW 0774053!; BP HNHM-TRA 00183965!); in lapidosis ad rad. montis Morrone, prope Solmona, 29 July 1873, *E. Levier s.n.* (BEOU!; WU 0105414!); In incultis lapidosis, ad radices montis Morrone, 26 July 1856, *E. & A. Huet du Pavillon 282* (B 10 0588440!; WAG 1314153!); In Aprutiis, s.d., *G. Gasparrini s.n.* (PAL 54037!); In rupestribus et glareosis ad basin montis Morrone supra Sulmonam, montis Como supra Aquilam, in Aprutis Neapolitano, August 1844, *Leresche s.n.* (L 1702787!); Caramanico, Abruzzo, 28 June 1887, *s.coll. s.n.* (WU 105418!); Sulmona, Abruzzo, 7 July 1887, *s.coll.*,



*s.n.* (WU 105414!); Abruzzo, L'Aquila, Gole di Appari, carbonate rocks along the road, 724 m alt., 29 June 2021, *Rešetnik, Bogdanović, Temunović & Terlević s.n.* (ZA 62649!, ZAGR 62677!); Abruzzo, road between Popoli and Collepietro, along the road, 556 m alt., 30 June 2021, *Rešetnik, Bogdanović, Temunović & Terlević s.n.* (ZA 62650!, ZAGR 62678!); Abruzzo, Pacentro, along the road, scree, 694 m alt., 30 June 2021, *Rešetnik, Bogdanović, Temunović & Terlević s.n.* (ZA 62651!, ZAGR 62679!); Abruzzo, Case Sambuco, near Roccascalegna, along the road, 308 m alt., 1 July 2021, *Rešetnik, Bogdanović, Temunović & Terlević s.n.* (ZA 62652!, ZAGR 62680!).

***Dianthus ciliatus* subsp. *dalmaticus***:—**BOSNIA AND HERZEGOVINA**. Mostar, in collibus ad urbem, August 1907, *E. Sagorski s.n.* (P 05079695!); Mostar, in collibus ad urbem, July 1907, *E. Sagorski s.n.* (BP HNHM-TRA 00183941!); Hum, Mostar, 18 July 1911, *J. Schneider s.n.* (W 0082736!); Podveleš, Mostar, 24 July 1911, *J. Schneider s.n.* (W 0082737!); In saxosis montis Gliva prope Trebinje, ca 600 m s.m., July 1891, *K. Vandas 1545* (W 0082768!); Studenci village, Trebižat river, Kravice waterfalls, near Ljubuški, rocky grassland along the road, 75 m alt., 19 June 2018, *Rešetnik, Bogdanović & Ljubičić s.n.* (ZA 47460!); Mostar, road Gornji Vukodol to Donji Vukodol, rocky grassland along the road, 250 m alt., 19 June 2018, *Rešetnik, Bogdanović & Ljubičić s.n.* (ZA 47462!); Trebinje, near Todorjaei, Aleksina međa, rocky stones, scrub, edge of forest, 319 m alt., 17 July 2018, *Bogdanović & Ljubičić s.n.* (ZA 48624!); Trebišnjica river valley, Popovo polje (valley), Dračevo village, under Crvene stijene, rocky cliffs along the road, 310 m alt., 29 June 2019, *Rešetnik, Bogdanović, Ljubičić & Terlević s.n.* (ZA 54965!); Pađeni, rocks along the road, 300 m alt., 25 July 2021, *Rešetnik, Doboš & Ljubičić s.n.* (ZA 62658!); Mt Hrgud foothills, rocks along the road, 556 m alt., 25 July 2021, *Rešetnik, Doboš & Ljubičić s.n.* (ZA 62659!). **CROATIA**. Dalmatia. Ragusa: Kalkfelsen im Omblatal, 18 July 1901, *L. Gross s.n.* (P 05079635!); Dalmatia, Gravosa, August 1912, *H. Laus s.n.* (BP HNHM-TRA 00183942!); Dalmatia, Gravosa, August 1913, *H. Laus s.n.* (BP HNHM-TRA 00183958!); Kalks bei Gravosia Anunciata, Kalk, 200 m, 16 October 1912, *R. Berger s.n.* (IB 5792!); Flora Dalmatica, In saxosis int. ... [illeg.], s.coll., s.d., (IB 5791!); Dalmatia merid., in saxis calcareis ad fontem fl. Omblata prope Gruž, 29 July 1928, *Th. Šoška s.n.* (BEOU!); Dubrovnik, Srđ, 300-400 m, karbonatni kamenjar, 24 May 1988, *D. Lakušić s.n.* (BEOU!); Dalamtien, an steinigen Hängen b. Dubrovnik, August 1928, *O. Fiedler s.n.* (B 10 1040389!); Insel Lokrum von Dubrovnik im Adriatischen Meer, 13 July 1967, *H. & E. Walter* (B 10 1040388!); Ragusa, 1840, *G. Clementi s.n.* (B 10 0749488!); Um Ragusa in Dalmatien, 15 June 1867, *E. Huter s.n.* (B 10 0749141!); Ragusa, ad rupestrib., August 1909, *L. Adamović & E. Sagorski s.n.* (W 0082740!); Dubrovnik, Dalmatia, October 1933, *L. H. Siertsema s.n.* (L 1702735!); Supra opp. Dubrovnik, in calcareis, 23 September 1957, *P. Jakucs & G. Fekete s.n.* (BP HNHM-TRA 00183975!); Dubrovnik, Srđ hill, summit plateau, Križ, rocky grassland, 279 m alt., 12 May 2018, *Rešetnik & Bogdanović s.n.* (ZA 46278!); Dubrovnik city area, Zaton bay, Zaton, along the road Jadranska magistrala, vertical rocks along the road, 7 m alt., 13 May 2018, *Rešetnik & Bogdanović s.n.* (ZA 46280!); Biokovo Mt., Samograd peak, road to Sv. Jure peak, vertical rocks along the road, 757 m alt., 18 June 2018, *Rešetnik, Bogdanović & Ljubičić s.n.* (ZA 47458!); Neretva, road Opuzen to Raba, Timor, rocky stones along the road, 160 m alt., 29 June 2019, *Rešetnik, Bogdanović, Ljubičić & Terlević s.n.* (ZA 54967!); Vrgorac, Matokit Mt, Prapatnice, Duboka draga, rocky grassland, 385 m alt., 12 September 2019, *Vukojević s.n.* (ZA 54973!); Kamešnica, Blaca, rocky grassland along the road, 876 m alt., 22 July 2020, *Bogdanović s.n.* (ZA 56820!); Mt Kozjak, Lukovo, below Veli vrj, dry grassland along the road, 370 m alt., 27 July 2021, *Bogdanović s.n.* (ZA 62664!); above Slano, along the road, deciduous forest edge, 197 m alt., 31 July 2021, *Bogdanović s.n.* (ZA 62672!). **MONTENEGRO**. Auf steinigem Boden am Giovanni, Cattaro, July August 1877, *K. Studniczka s.n.* (WU 105416!); 4 km E of Morinj (in the Kotor-Bay), Open scrub on dry slopes, 20 August 1977, *P. Frost-Olsen 1428* (P 00897986!); Dalmatia, in rupibus creites ad Fort Sti. Johannis supra Cattaro, July 1885, *Th. Pichler s.n.* (P 05082524!; B 10 1003122!, PAL 54040!; BP HNHM-TRA 00183959!); Dalmatia: in rupibus ad St. Johann prope Cattaro, s.d., *Th. Pichler 2507* (BP HNHM-TRA 00183943!; BP HNHM-TRA 00183932!; BP HNHM-TRA 00183934!; BP HNHM-TRA 00183936!; IB 5829!; BEOU!; L 1702795!; MW 0774204!); Rijeka Crnojeviæa, Poseljani, 25 August 2006, *V. Stavanović s.n.* (BEOU 21963!); Lovæen, Štirovnik (ispod), kreènjak, 1300 m, 8 August 2008, *V. Stevanović & B. Stevanović s.n.* (BEOU 28550!); Orjen, Orjensko sedlo-Krivošije, stene, kreènjak, 1400 m, 1 August 2008, *V. Stevanović & B. Stevanović s.n.* (BEOU 28468!); Kotor, zidine stare tvrðave, 8 August 1990, *S. Jovanović & R. Petanović s.n.* (BEOU 2308!); Tivat, Lepetane, Èimarica, 19 September 1995, *V. Karaman 1168* (BEOU 26735!); Dalmatia merid., in saxis calcareis infra pagum Kameno, 18 July 1928, *Th. Šoška s.n.* (BEOU!); Dalmatia merid., in saxis calcareis ad Grèirda (Kotor), 16 July 1928, *Th. Šoška s.n.* (BEOU!); Krstac pr. Njeguši, July 1921, *J. Rohlena s.n.* (B 10 0551944!); Budva, ad viam publicam inter oppidula Sveti Stefan et Petrovac, in aproximitate autocampi Crvena Glavica, alt. 50-120 m s.m., in locis petrosis et graminosis, 18 July 1982, *F. Èernoch 39318* (B 10 1040387!, L 1702803!); Kalkfelsen zwischen Cetinje ü. Negus, s.d., *W. Gugler s.n.* (BP HNHM-TRA 00183944!); Strassenräuber bei Cetinje, s.d., *W. Gugler s.n.* (BP HNHM-TRA 00183945!); Auf Felsen an der Fahrstraße von Cattaro nach Cetinje, 6 September 1990, *V. Engelhardt s.n.* (B 10 1040393!); Cattaro, s.d., *Baschant s.n.* (B 10 1040390!);

Cattaro, in calcareis, July 1898, *E. Sagorski s.n.* (B 10 1040395!); In rupestr. supra Krstac pr. Njeguši, ca. 900 m, July 1929, *J. Rohlena s.n.* (B 10 1040 397!); Montenegro, Felsen bei Krstaè, 24 July 1929, *K. Ronniger s.n.* (W 00850 045!); Dalmatien, Auf Felsen bei Cattaro, July 1870, *Th. Pichler s.n.* (B 10 0749139!); Dalmatia, in aree St. Joannis, supra Cattaro, loc. rupestr., July 1870, *Th. Pichler s.n.* (B 10 1040378!; B 10 1040376!; L 1702802!); Lovcen-Pass, 1000 m, 29 September 1970, *s.coll.* (B 10 1040377!); Felsen bei ... [illeg.] nächst Cattaro, 11 July 1927, *unclear collector s.n.* (W 0082739!); Dalmatien, Golf von Cattaro. In Weinbergen bei Ober-Stolivu, 11 July 1927, *E. Korb s.n.* (W 0082769!, W 0082770!, W 0082771!); An Felsen an der Straße Kotor - Njeguši zwischen Zanjev und Krstac, 25 July 1929, *H. Zerny s.n.* (W 0082772!); Cattaró, an Kalkfelsen, loc. class., 1 August 1897, *E. Sagorski s.n.* (W 0087986!); Krstac pr. Njeguši, July 1903, *J. Rohlena s.n.* (PI 040854!); Crna Gora, Cetinje, Lovcen, 700 m, rocky roadside verge, 42° 20' N, 18° 45' E, 25 July 1984, *M. F. Gardner & S. G. Gardner 2349* (E 00121710!); limestone hillsides by the main road above Petrovac, between Budva and Bar, 12 July 1976, *G. Halliday 96/97* (E 01024676!); Sutomore, Zlatna obala, vertical rocks along the road, 70 m alt., 15 July 2018, *Bogdanović & Ljubičić s.n.* (ZA 48616!); Ulcinj, Valdanos to Bratica road, SW slopes of Marjan hill, vertical rocks along the road, 279 m alt., 15 July 201, *Bogdanović & Ljubičić s.n.* (ZA 48617!); Budva to Cetinje road, Brajiæi village, road to Kosmaè fort, rocky grassland, 808 m alt., 16 July 2018, *Bogdanović & Ljubičić s.n.* (ZA 48618!); Kotor, road to Lovæen, Lovæenske strane, vertical rocks along the road, 634 m alt., 16 July 2018, *Bogdanović & Ljubičić s.n.* (ZA 48621!); Orjen Mt., Orjen sedlo, SE slopes of Zubaèki Kabao, 1689 m alt., 17 July 2018, *Bogdanović & Ljubičić s.n.* (ZA 48622!); road towards Grahovo, rocks along the road, 800 m alt., 24 July 2021, *Rešetnik, Doboš & Ljubičić s.n.* (ZA 62656!); Grahovo, rocks along the road, 843 m alt., 24 July 2021, *Rešetnik, Doboš & Ljubičić s.n.* (ZA 62657!); Ðuroviæi, rocks along the road, 53 m alt., 5 August 2021, *Bogdanović s.n.* (ZA 62674!, ZAGR 62681!); Karasoviæi-Debeli brijeg, on the state border, rocks along the road, 180 m alt., 5 August 2021, *Bogdanović s.n.* (ZA 62675!, ZAGR 62682!); Kuaèiða, border cross Ilijino Brdo, rocks along the road, 981 m alt., 31 July 2021, *Bogdanović s.n.* (ZA 62676!, ZAGR 62683!); Skadar, Virpazar to Sutomore road, above Crmnièko polje, Gluhi dol, before the tunnel, vertical rocks along the road, 143 m alt., 15 July 2018, *Bogdanović & Ljubičić s.n.* (ZAGR!); Petrovac, Peraziæa Do, road Petrovac to Budva, vertical rocks along the road, 160m alt., 16 July 2018, *Bogdanović & Ljubičić s.n.* (ZAGR!); Lovæen Mt., road to Jezerski vrh, above Źanjev Do village, Gomile, vertical rocks along the road, 1153 m alt., 16 July 2018, *Bogdanović & Ljubičić s.n.* (ZAGR!); Boka Kotorska bay, between Kamenari and Kostanica, Turski Rt, vertical rocks along the road, 15 m alt., 16 July 2018, *Bogdanović & Ljubičić s.n.* (ZAGR!); Herceg Novi, above, Kameno, between Gruæalica and Źilobod, vertical rocks along the road, 480 m alt., 17 July 2018, *Bogdanović & Ljubičić s.n.* (ZAGR!).

***Dianthus ciliatus* subsp. *medunensis*:**—ALBANIA. Iter albanicum quintum, 1897, *A. Baldacci 156* (P 04931614!, P 04931618!); In calcareis versus lacum Scodranum ad Zogaj distr. Scutani, 1 August 1897, *A. Baldacci 156* (P 04931613!); Kruje town, on the walls of the castle, 636 m alt., 26 June 2019, *Bogdanović, Ljubičić, Rešetnik & Terlević s.n.* (ZA 54949!, ZAGR 62684!); Mat river canyon, close to Shkopet village, carbonate cliffs along the road, 86 m alt., 26 June 2019, *Bogdanović, Ljubičić, Rešetnik & Terlević s.n.* (ZA 54950!, ZAGR 62685!); Balldreni village, rocky pastures along the road, carbonate, 42 m alt., 27 June 2019, *Bogdanović, Ljubičić, Rešetnik & Terlević s.n.* (ZA 54952!, ZAGR 62686!); Shkodër (SW of the town), Shkodër lake, towards Shiroka Village (Shirokë), beginning of Bojana river, vertical rocks along the road, 49 m alt., 27 June 2019, *Bogdanović, Ljubičić, Rešetnik, Terlević s.n.* (ZA 54955!, ZAGR 62687!); Dajti NP, Eastern slopes of Dajti Mt, above the road from Qafëmolla Pass to Qafëmollë village, on carbonate rocks, 970 m alt., 21 August 2020, *D. Shuka s.n.* (TIR!, ZA 56849!, ZAGR 62688!); Tirana river, 150 m below the Shkalla e Tujanit Bar Restaurant, on both sides of limestone rocky slopes of the river, 220 m alt., 20 July 2021, *D. Shuka s.n.* (herb. Shuka); Kruja Mt., at the peak of mountain, near the religious Bektashi holy place, named Sari Salltek, 1100 m alt., 19 September 2020, *D. Shuka s.n.* (TIR!, ZA 57634!, ZAGR 62689!); Vau i Dejës municipality, 10-30 m over the hydropower dam of Vau i Dejës, 100 m alt., 20 August 2020, *L. Shuka & D. Shuka s.n.* (ZA 57635!, ZAGR 62690!); Shkodra district, Vau i Dejës municipality, 10-30 m over the hydropower dam of Vau i Dejës, 42°0'58.25"N; 19°38'26.64"E, ca. 85-120 m a.s.l., 20 September 2020, *D. Shuka & L. Shuka s.n.* (TIR!, ZAGR!); Koplik Dedaj, ca. 350-400 m. 28 July 1963, *s.coll. s.n.*, (TIR!); Koplik, Fusha e Zezë, Kunora e Kastratit, 1300-1800 m, limestone, 26 July 1963, *I. Mitrushi & Sh. Zgjani s.n.* (TIR!); Mali me Gropa (calcar). 1600m, 20 July 1984, *V. Tartari s.n.* (TIR!); Kruje town, on the walls of the castle, 5 August 2021, *Bogdanović s.n.* (ZAGR!). **MONTENEGRO.** In rupibus calcareis circa Medun et ... [illeg.], 26 June 1891, *A. Baldacci s.n.* (P 04931617!); Peljev Breg, karst u dolini Moraèe, 16 August 1912, *N. Košanin s.n.* (BEOU!); In rupestribus calcareis circa Medun et Scuderia, 26 July 1831, *A. Baldacci s.n.* (E 01053136!); Moraèa river canyon, N of Podgorica, under Tisov vrh, vertical rocks along the road, 288 m alt., 15 July 2018, *Bogdanović & Ljubičić s.n.* (ZA 48614!, ZAGR 62691!); Medun above Podgorica, ruderal along the road, 472 m alt., 15 July 2018, *Bogdanović & Ljubičić s.n.* (ZA 48615!, ZAGR 62692!); Podgorica, close to Moraèa to Zeta rivers confluence, Duklja ruins, the walls of the old town Duklija, 88 m alt., 28 June 2019, *Bogdanović, Ljubičić,*

*Rešetnik, Terlević s.n.* (ZA 54961!, ZAGR 62693!); Ostroška Greda Mt., Ostrog, rocky carbonate cliffs along the road, 319 m alt., 28 June 2019, *Bogdanović, Ljubičić, Rešetnik, Terlević s.n.* (ZA 54962!, ZAGR 62694!); Danilovgrad, along the road, deciduous forest edge, 90 m alt., 31 July 2021, *Bogdanović s.n.* (ZA 62673!, ZAGR 62695!).